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AUTHOR Rezabek, Landra L.; And Others
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ABSTRACT

By combining the use of an existing teleconferencing network with new computer-based video technologies, the University of Wyoming has enhanced its ability to provide distance educational opportunities for students at remote sites across the state. The new computer-based audiographic system was tested during the fall semester of 1988 during the delivery of a course in visual literacy. In addition to the computer-based telecommunication system, instructional support for the delivery of the course included print materials, 16mm film, slides, and videotapes, which were mailed to the two sites where classes were held. Course development concerns included: (1) maintaining consistency between on- and off-campus sections of the course; (2) humanizing the delivery system; and (3) dealing with unique instructional design and delivery demands which emerged from the use of the technologies. Some of the suggestions for the design and development of similar courses using computer-assisted instruction and audiographic telecommunication systems include acknowledging the capabilities and limitations of the delivery system; reducing technophobia; and cautioning the students and teacher of the time, flexibility, and energy demands of the delivery system. (Author/DB)

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USING A COMPUTER-BASED AUDIOGRAPHIC TELECOMMUNICATION SYSTEM FOR DISTANCE LEARNING

Landra L. Rezabek, Diane D. Nordman, and James M. Shaeffer

The University of Wyoming

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Abstract

By combining the use of an existing teleconferencing network with new computer-based video technologies, the University of Wyoming has enhanced its ability to provide educational opportunities for students at remote sites across the state. The new computer-based audiographic system was tested during the fall semester of 1988 during the delivery of a course in visual literacy. Course development concerns included: 1)maintaining consistency between on- and off-campus sections of the course, 2) humanizing the delivery system, and 3) dealing with unique instructional design and delivery demands which emerged from the use of the technologies. Some of the suggestions for the design and development of similar courses using a computer-based audiographic telecommunication system inlcude: 1) acknowledging capabilities and limitations of the delivery system, 2) reducing technophobia, and 3) cautioning students and instructors of the time, flexibility, and energy demands of the delivery system.

Introduction

Distance education is characterized by interaction among a teacher and learners who are separated geographically but who communicate using various delivery modes and diverse types of mediated technology to accomplish course objectives. Distance education, enhanced by newer technologies, has opened doors for reaching larger and more diversified groups of learners who have not been served by traditional on-campus courses. In Wyoming, a state with one four-year university serving students in remote communities, distance learning has become a viable approach to continuing education. Extended learning opportunities have been available to distant learners in Wyoming for many years, though funds have been limited. By incorporating an existing audio teleconferencing system, the recent addition of computer-based graphic capabilities has greatly expanded the ability of the University of Wyoming to meet the needs of distant learners. This paper summarizes successes and frustrations experienced in the design and delivery of the first course offered by the University of Wyoming using the new computer-based audiographic telecommunications system and offers suggestions to users of similar systems.

Technological Support Available for Distance Learning

The University of Wyoming has a history of providing correspondence study for remote learners. Face-to-face instructional opportunities also are made possible by transporting faculty members to locations across the state. Additionally, a state-wide audio telecommunication network was established in the mid 1980's, enabling instructors to remain on campus while working with students in remote locations. In 1987, a video classroom was built from which selected courses were videotaped and the tapes were then mailed to students at selected sites. Budget constraints have precluded the use of satellite or microwave technologies to date, and a means of best utilizing the existing audio telecommunications link and video facilities was sought.

A computer-based audiographic system which incorporated existing audio technology was set up and tested at three locations during the fall of 1988. The systems used at three sites (Laramie, Rawlins, and Douglas) consisted of an Epson computer with a portable hard disk drive storage system, two monitors (one RGB for video images and one composite for graphics), a 1200 BPS Voice-Too modem by Optel, Telewriter 3-PC software with an Image Capture Board (ICB), an electronic penpad, and the audio teleconferencing phone link. With the Voice-Too

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modem only one phone line was necessary for simultaneous transmission of both data and voice. Laramie was the base site with the instructor directing the other systems, though Rawlins or Douglas could also control the systems, as needed.

The computer-based audiographic system was established because of its potential to be used interactively by participants at all three sites. Audio teleconferencing provided voice interaction while the graphic tablet/penpad and keyboard allowed for limited real-time visual feedback and interaction. Video images previously captured on the hard disk and mailed to the sites were "called up" and used during audio teleconferencing. Unfortunately, the transmission of real-time still-frame video images required capabilities beyond those of the current system and this option was not available.

The Course to Test the System

An introductory course in *visual literacy* was chosen as the first class to be delivered on the computer-based audiographic system. The content of the course itself was one factor influencing this decision. A course in visual literacy, appropriately enough, required a great number and a wide variety of instructional visuals. Course designers wanted to test the limits of the system to provide visual/graphic interaction among students and the instructor, and this course demanded a great deal from the technologies. A second factor influencing the decision was that the instructor taught courses in the instructional technology program area and was personally interested in testing the technology. Since the visual literacy course was offered for credit in instructional technology, many of the students who enrolled also shared a curiosity in the computer-based audiographic system. Another consideration was that the visual literacy course was being taught on-campus during the same semester it was taught off-campus, providing an opportunity to compare the two courses.

In addition to the computer-based telecommunication system, instructional support for the delivery of the visual literacy course included print materials, 16mm film, slides, and videotapes which were mailed to the two sites where classes were held. A facilitator not enrolled in the course was employed at each class location to oversee the distribution and use of these materials and to monitor the system. A FAX link was established toward the end of the course which also enhanced the transmission of information among sites, but the students and instructor were not able to use the FAX link to communicate directly.

Course Development Concerns

In developing the visual literacy course for delivery via the computer-based telecommunication system, the instructor had three primary questions: 1) how can this course maintain as much consistency with the on-campus course as possible? 2) how can this course be as *human* as possible? and 3) how will the preparation and delivery demands differ from an on-campus course?

Consistency

The instructor of the course was committed to designing an off-campus version of the visual literacy course which was the equivalent of the on-campus section in every aspect possible. Course goals, specific objectives, course requirements, and grading criteria were identical for both sections. Though the sequencing of the content was similar, scheduling modifications were necessary in the off-campus version of the course. Students were asked to submit numerous visual assignments, and time was needed to receive off-campus students' work in the mail, transfer the images to videotape, capture the still-frame video images onto the portable hard disks, and return the disks which contained the captured images to the class sites so the assignments could be viewed and discussed.

It might have been feasible to have students at each individual site view and discuss the "local" class projects, but neither the instructor nor the students at the other locations would have shared in the dialogue. The instructor chose to make modifications in the course schedule so that all of those enrolled off-campus could view the work of the other off-campus participants. Though this procedure required students to submit work and then wait for periods of up to two weeks before discussing the assignments as a group, students did not mention this logistical manipulation as a weakness of the course.

Humanizing the Technology

A major concern of the instructor was how to maintain as much *high-touch* as possible while using a relatively *high-tech* delivery mode. One strategy was to mail a short biography and photograph of the instructor to students prior to the class in order to provide "a face to go along with the voice" of the instructor. During the first class session, students used the graphic capabilities of the system to draw self-portraits or other visuals to help introduce themselves to other class members, and the instructor did the same. Students were required to produce self-portrait

collages composed entirely of visuals which were shared in class, and the instructor also produced a collage and participated in the discussion. This activity encouraged interaction and helped both students and the instructor realize that *real people* were actually involved in the distance learning experience.

Another concern relating to the *human* factor involved in the computer-based telecommunication course was how to provide students with feedback from the instructor and, conversely, how the instructor could receive feedback from students. During the development of the course, the instructor had hoped both visual and verbal exchange would be possible. Unfortunately, the capability of the system to transmit visuals in real time was extremely limited. Slow-scan image transmission required almost 15-20 minutes to complete and audio interaction was impossible during this period. Therefore, the instructor used the audio component of the system, the computer keyboard, and the graphics tablet/ penpad to encourage interaction and feedback during class. Though visual feedback was possible by using the computer keyboard or the graphics tablet/penpad, students usually verbalized rather than visualized their questions and comments. Students both solicited feedback from the instructor and responded to the teacher's requests for information primarily using the audio mode. In retrospect, students indicated a greater familiarity and comfort level with the microphones than they did with the computer. In future courses taught using this system, the instructor will allow more time for students to become familiar with the computer-based technology and will require students to use the visual communication capabilities of the computer-based system more frequently.

Preparation and Delivery Demands

In preparing and delivering the course using the computer-based audiographic system, the instructor found that time, flexibility, and energy level were the three key factors affecting the successes or problems with the course from week to week. Although the design and development of the course was complete prior to the beginning of the semester, preparing for weekly three-hour sessions was extremely time consuming. The instructor initially devoted personal time to learn and then to review basic operation of the computer-based delivery system. Although computer-generated instructional visuals were produced by others, the instructor was responsible for designing and/or requesting visuals and other materials at least two weeks in advance. Though this procedure encouraged advanced organization and structuring of the course, it required a great deal of pre-delivery planning and inhibited spontaneous modifications.

Using the computer-based audiographic system also required a great deal of flexibility on the part of the instructor. As indicated above, it was difficult to make spontaneous changes or to provide additional information, especially if visuals were required, so the instructor had to think of alternative instructional approaches or examples which would work within the constraints of the system. The graphics tablet/penpad proved to be the communication medium most helpful to the instructor when real-time visual examples were needed, but the audio link proved to be the most flexible medium to use during the delivery of the course.

The computer-based telecommunications system also required another type of flexibility on the part of the instructor. During the semester various problems with the technologies were encountered: the computers at one location or another would go down or fail to boot, a faulty disk would be discovered, the audio transmission would be garbled, or the telecommunications link would be lost. Technological quirks demanded flexibility — and patience — on the part of both students and the instructor.

The most unexpected demand upon the instructor was the high degree of energy required to actually deliver the course each week. In addition to the traditional efforts associated with delivering instruction, the computer-based audiographic system required the instructor to use the technology effectively as well. Turning the microphone on and off, switching the computer from keyboard to graphics tablet/ penpad mode, or calling up the correct pages of computer graphics from the hard disk were tasks to be accomplished while delivering course content. Though the demands associated with using the technology eventually might become less obtrusive over time and with practice, this was not the experience of the instructor. The instructor felt that two levels of functioning were required — an awareness of what was being said regarding the course content as well as an understanding of how to manipulate the technologies in order to deliver the information. These endeavors required not only a great deal of planning but a great expenditure of energy as well.

Capabilities and Limitations of the System

In retrospect, the computer-based audiographic telecommunication system did provide an opportunity to offer a course to distant learners which would not have been possible without the visual/graphic capabilities provided by the computer. Although the particular system used was relatively elementary, it enabled the exchange of visual information which was necessary for a *visual literacy* course to succeed.

Though the process was cumbersome and time-intensive, students' visual projects and instructor-selected materials could be captured on hard disks and distributed for viewing and analysis. The graphics tablet/penpad could also be used while the visuals were being displayed on the computer monitor so that specific areas of an image could be pointed to or marked on the screen.

A degree of visual interactivity did exist among students themselves and the instructor, but as discussed previously, real-time visual exchange was limited. A further frustration was the quality of images captured on disk. Details were often difficult to see when viewing an entire image, and when close-up shots were taken visuals lost much of their impact. Monitor resolution was not high, and more monitors or a larger monitor were needed at the sites for students to be able to view the visuals efficiently.

In terms of the audio component of the system, the major limitation was that when the computer-based component of the system was in use, transmission noises interfered with audio quality. When visual/graphic capabilities of the system were utilized, audio transmission was unavailable, precluding simultaneous visual/verbal instruction. Two other limitations of the system surfaced in students' evaluative comments. First, students were concerned that they could not see the instructor. This uneasiness mirrored the instructor's concern over not being able to give or receive visual feedback, as discussed above. Second, student comments reflected a high degree of discomfort in actually using the technology to interact with fellow students and the instructor. Students were intrigued by the experience of receiving information via a computer-based audiographic system but indicated that using the system inhibited them and at times discouraged them from participating in class. These technophobic tendencies may have been lessened if the students had more opportunity to experiment and interact with the technologies.

Suggestions and Caveats

Based upon the evaluations from students, instructor, administrators, and support staff, the following recommendations and considerations are offered for those planning to use a computer-based audiographic system to provide distance learning opportunities.

Build on practices and procedures which have worked before. Literature on distance education and telecommunications offers numerous guidelines for conducting successful learning experiences with individuals located at diverse sites. While suggestions such as calling on individuals by name to answer questions, using teaching methods such as panel discussion and group work to encourage on-site interaction, and conveying personal enthusiasm may seem elementary, remembering the basics were important for the instructor when using the computer-based system. Allowing adequate time for students at each site to discuss questions and respond was difficult for the instructor who was unable to see if students were actually working on the problem. But *wait time* became extremely important when students were formulating answers without the aid of visual cues from the instructor.

Another lesson learned by the instructor was the importance of directing students to talk to each other rather than through the instructor. Students at the two sites tended to avoid direct communication with each other and would respond to other class members' comments by addressing the instructor rather than speaking directly to their peers. Once this tendency was pointed out, students began to dialogue with each other, which helped make the technology more transparent by increasing the sense that other *real people* were involved in the class.

Finally, feedback remained a concern for both the instructor and students. The instructor found that important points had to be repeated or reemphasized more frequently than during on-campus courses. Main ideas needed to be restated frequently by students or the instructor in order to check on the accuracy of the information received. The instructor also needed to solicit feedback about pacing, audio clarity and volume, resolution and clarity to visual images, and problems associated with the operation of the technologies. Furthermore, the instructor found that some students who were uncomfortable asking questions in class appreciated the opportunity to contact the instructor individually by phone with questions or concerns. Though this procedure required more time and energy on the part of the instructor, it added to the success of the course. Incorporating basic guidelines for the delivery of telecommunications courses aided the instructor in using the computer-based audiographic system.

Combat technophobic reactions. Though many of the students involved in the course were interested in taking a course using the computer-based system, numerous students expressed discomfort when actually using the technologies. Using the microphones was disconcerting and students worried when working with the computer-based graphics tablet/penpad or keyboard. Though efforts were made to introduce and familiarize students with the opera-

tion of the technologies, additional emphasis will be placed on acquainting students with the hardware in the future.

Since only one computer-based system was available at each location, students had limited opportunities to use the system. Additional systems would provide greater opportunities for students to use the technologies and would also enhance the ease with which students could view information being displayed on the computer monitors. Students might also be given time outside of class to experiment with the capabilities of the technologies. And students could be encouraged to use the system by requiring each individual to respond more frequently in class. Although assignments required each student to use technologies at times, individuals at each site emerged who tended to assume responsibility for responding for the group. This proclivity for a group spokesperson to emerge could be redirected by assigning a different student each week to be in charge of relaying group responses. Students supported each other in their efforts to use the technologies and could be encouraged to help their peers become comfortable with the computer-based system.

Consider using all available delivery resources. Although the computer-based audiographic telecommunications system was the backbone of the delivery system, the course would not have been feasible without the exchange of assignments and information through the mail and via FAX transmission. Hard disks, print materials, 16mm film, videotape, slides, student assignments, and evaluations all required surface delivery. One comment made by students was that more concrete examples of projects rather than video reproductions would have been helpful, and these could have been supplied through the mail. The FAX link was invaluable in transmitting last-minute information among sites and will be utilized more frequently in the future. As stated above, many students found private telephone contact with the instructor beneficial. Supplementing the computer-based system with additional delivery resources enhanced the course and extended the options available to students and the instructor for interaction during the class.

Emphasize the high-touch — the high-tech is apparent. The transparency of the technology may affect students' acceptance and use of the hardware utilized to deliver courses and may subsequently influence the learners' attitudes toward the course itself. The instructor found that students were quite aware of and sensitive to the use of novel technologies, but by placing emphasis on the interpersonal aspects of learning and instruction, students were encouraged to look past the delivery system and focus on course content. Collaborative group assignments, calling on individuals by name, having students describe themselves and their environment, talking informally with students during breaks or on the phone, sharing visuals, telling jokes or talking about the weather at different sites, and encouraging participants to interact as much as possible were all strategies used to underscore the fact that the technologies were just being used to help *people* communicate more efficiently. If involved in a course using the computer-based system again, the instructor would like to travel to individual sites and teach once from each location. Strategies such as these may enhance the *human* aspects of the course and lessen student concerns over the delivery system itself.

Consider time, flexibility, and energy requirements. These three factors heavily impacted the instructor. And, to some degree, these factors affected the students involved in the course as well. Both students and the instructor should be advised prior to making a commitment to a similar course of the time expenditures projected, the patience and flexibility often demanded by the use of technologies, and the energy levels necessary to foster a successful distance learning experience. The demands of participating in a course delivered by the computer-based audiographic system were greater for the instructor in terms of time, flexibility, and energy than were the demands of teaching the same class on campus. Other individuals involved in establishing and maintaining the off-campus program also contributed significantly in terms of time, energy, and effort. However, based upon student, administrator, instructor, and staff evaluations, the expenditure of energy resulted in the effective use of the computer-based telecommunications system to deliver a course to interested, appreciative learners.

Summary

Both obstacles and advantages are inherent in distance education and the use of a computer-based audiographic telecommunication system. In developing a course delivered by a computer-based audiographic telecommunication system, the instructor initially was concerned about maintaining consistency between the off-campus version of the course and the on-campus section of the class, emphasizing the *high-touch* aspects of the course while using a *high-tech* delivery mode, and meeting any additional preparation and delivery demands imposed by the use of the computer-based telecommunication system. Though limitations to the use of the technologies surfaced and

the instructor's concerns were justified, use of a computer-based audiographic system proved effective in delivering a course in *visual literacy* to remote sites. Suggestions for using similar computer-based systems include: 1) follow general heuristics for the delivery of courses via telecommunications systems, 2) reduce technophobia, 3) use all available resources to communicate, 4) emphasize the *human* aspects of the course, and 5) be cognizant of time, flexibility, and energy requirements demanded by the use of the technologies. Success and frustrations experienced in the design and delivery of a course using a computer-based audiographic telecommunication system suggest that the use of these technologies has increasing potential for assisting in the delivery of future courses to distant learners.

Landra L. Rezabek
Diane D. Nordmann
James M. Shaeffer

College of Education, Box 3374
Laramie, Wyoming 82071-3374
(307) 766-3608